U. S. DEPARTMENT OF COMMERCE

# Technical News Bulletin

of the

## National Bureau of Standards

★ *Issued Monthly* ★

Washington MARCH 1937 Number 239

CONTENTS

Radio-meteorograph system.
Performance characteristics of a water current meter.
Calibration of a "constant rate of loading" machine for testing textiles.
Reaction of wool with strong solutions of sulfuric acid.
Determination of alpha, beta, and gamma cellulose in pulps and papers.
Permeability of packaging materials to water vapor.
Field tests of nonbituminous pipe coatings for underground use.
Hydrocarbons in a midcontinent petroleum.
Optical rotation and atomic dimension for the four optically active 1-halogeno-2-methylbutanes.
Preparation of thin films.
Surface tension of molten enamels.
Relation between water content and flow pressure of a clay.
Recent progress in engineering materials.
Anodizing of aluminum alloys in chromic acid solutions.
Determination of oxygen in steel.
Superconducting transition of tantalum and of tin.
Analysis and specification of color.
New circular on inks.
New and revised publications issued during February 1937.
Mimeographed material:
Letter circulars.
Technical information on building materials.
Reports of National Hydraulic Laboratory.
Recent Bureau articles appearing in outside publications.

### RADIO-METEOROGRAPH SYSTEM

A radio-meteorograph system has been developed in the Bureau's Radio Section for use in the meteorological service of the U. S. Navy Department. It is expected that this system will eventually replace airplanes in gathering information on upper-air conditions required for weather forecasting.

The complete radio-meteorograph system comprises transmitting equipment for sending down from small unmanned balloons meteorological observations on upper-air pressure, temperature, and humidity; receiving and recording equipment on the ground for automatically plotting these data in the graphical form desired by meteorologists; and direction finders (also at the ground station) for tracking the flight of the balloon so as to determine upper-air wind conditions.

The instrument, sent aloft on a 5-foot balloon consists of a miniature radio transmitting set, batteries, and a meteorograph. The latter contains the devices for measuring pressure, temperature, humidity, and other elements desired. The complete equipment is housed in a balsa-wood box 6 by 6 by 4½ inches and weighs less than 2 pounds.

The meteorograph utilizes the decrease in atmospheric pressure as the balloon rises, for moving a small switch-arm over a set of electrical contacts separated by insulating strips. The contacts are so spaced that for a decrease in air-pressure equivalent to a few hundred feet rise of the balloon, the arm will move from one contact to the next. The arm on reaching selected contacts causes the radio transmitter to send down signals having predetermined audio notes which provide index marks for the pressure scale.

The contacts intermediate to the pressure-index contacts are wired to a resistor which is controlled by a bundle of human hair and hence varies as the

127094—37

hairs contact or expand with varying humidity conditions. The switch-arm, in passing over these contacts, switches the transmitter circuit so as to send down signals having an audio note which is proportional to the value of the resistor and hence to the humidity encountered. When the switch-arm passes over the insulating strips lying between the contacts, the frequency of the audio note is determined by the electrical resistance of a small glass tube filled with sulphuric acid. The resistance of this small column of acid changes markedly with the temperature so that the note which is sent down to the ground may be interpreted to evaluate the air temperatures at the various balloon heights. In one form of the balloon instrument, light intensity may also be measured, giving data valuable in determining the heights and vertical structure of cloud formations.

Automatic receiving and recording equipment are employed to plot these data graphically on a chart which moves under a pen controlled by the received signals. The pen sets itself according to the pitch of the audio note. The final record gives a complete picture of the variation of temperature, humidity, and any other elements included, as a function of height above the earth's surface.

Aside from the fact that this system provides meteorological observations to much greater heights than can be obtained by airplane ascents, and under all conditions of weather, the radio meteorograph affords still another important advantage over airplanes in that it permits the use of radio direction finder methods for tracking the path of the balloon, thereby giving data on upper-air wind conditions. To evaluate upper-air wind velocities, it is necessary to measure continuously the distance and azimuthal direction of the balloon from the ground station. Usual direction-finding methods, if applied to this problem, would require two or more ground direction finding stations separated by from 10 to 20 miles. The radio-meteorograph system contemplates the use of a single ground station, at which both the azimuthal direction and the angle of elevation of the balloon are measured. Initial experiments have been made on a specialized method for measuring the angle of elevation. This has hitherto not been considered feasible because of the electrical properties of the ground. Knowing the angle of elevation and the height of the balloon (the latter from the graphical indications of pressure, temperature, and humidity), the distance of the balloon from the ground station may be computed.

The radio meteorograph has several important advantages over other arrangements, because the air pressure does the switching. No rotating parts of external motive power are required. The instrument thus becomes simple to construct and low in cost. The latter is essential if the radio meteorograph is to replace the use of airplanes in this service.

The number of observations obtained during an ascent is independent of the rate of ascent of the balloon. If desired, a high rate of balloon ascent may be used in order to reduce the total time required for receiving a complete set of observations. To take full advantage of this feature, it is necessary that the temperature and humidity devices respond with sufficient speed to changes in these elements. The temperature device employed meets this requirement. Preliminary experiments are now being made, which it is hoped will lead to the development of a humidity device suitable to this purpose.

## PERFORMANCE CHARACTERISTICS OF A WATER CURRENT METER

In determining rates of flow in streams, rivers, and watersheds, to obtain information necessary for flood control and the development of water resources, the question has arisen as to the effect of the density of the fluid on the indications of the current meter by which the velocity of the flowing water is measured. The current meter used is generally of either the propeller or cup wheel type which indicates the water velocity by the rate of rotation of the propeller or cup wheel. These instruments are calibrated by towing through still clear water in a rating tank. In the field, the meters are sometimes used to measure the velocity of salt water, and if density affects the rate of the instrument the indicated velocities will be in error because the density of the salt water is higher than that of the fresh water in the rating tank. Again, flood waters may contain large quantities of silt and mud, producing a mixture which is more dense than clear water. Whether the effect on the meter is the same as that which would be produced by a homogeneous fluid of the same density is difficult to answer. Certainly, one effect of silt and mud is to increase the inertia of the fluid and to this extent the effect on the indications of the meter will be similar to that of a fluid of greater density.

The effect of density on two water current meters of the cup wheel type, known as the small Price meter, was studied by G. B. Schubauer and M. A. Mason, at the Bureau, by calibrating each meter, first in water by the usual towing method, and second in air by placing them in the wind tunnel. By the change from water to air a change in density by a factor of approximately 800 was secured. Two meters of the same type were tested in this way to avoid possible errors due to irregularities in any one meter.

Dimensional considerations showed that the number of revolutions of the cup wheel during 1 foot of travel of the fluid should be a function of the product of velocity by the square root of the density of the fluid, provided the bearing friction is constant and the Reynolds number is without effect on the performance of the instrument. Tests showed the effect of the Reynolds number to be negligible and verified the foregoing functional relationship. The form in which the variables occurred indicated that changes in bearing friction were just as important as changes in density, a given percentage increase in friction having the same effect as the same percentage decrease in density.

It was concluded that the changes in density ordinarily encountered in the field would have an entirely negligible effect on the accuracy of the meter. Insofar as an effect from this source is concerned the mud in the stream may be ignored. However, if particles of mud or slit get into the bearings, it is conceivable that changes in bearing friction can occur large enough to cause important errors.

RP981 in the March number of the Journal of Research should be consulted for a complete account of this work.

### CALIBRATION OF A CONSTANT-RATE-OF-LOADING MACHINE FOR TESTING TEXTILES

In an article prepared for Rayon Textile Monthly two methods are described for calibrating a constant-rate-of-loading machine of the tilting plane and rolling cart type, which has recently come into use in the textile industry. The use of this type of machine is provided for in the Proposed Tentative Specification for Textile Testing Machines, ASTM designation D76–35T, but no method is given for its calibration either in the specification or in the literature describing it.

One method is based on the use of a pulley and weights and the other on the use of calibrated springs. A typical load-elongation curve for both loading and unloading is shown and the significance of its various parts is discussed in relation to use of the calibration.

### REACTION OF WOOL WITH STRONG SOLUTIONS OF SULFURIC ACID

The use of strong solutions of sulfuric acid for the removal of cotton from mixtures with wool has been recommended by a number of investigators. In addition, sulfuric acid is widely used in wool manufacturing in the dyeing and the carbonizing processes.

It has been shown that wool reacts with strong sulfuric acid to form a relatively stable compound. The combined acid cannot be removed by prolonged washing with water or alkaline reagents. An investigation was, therefore, undertaken at the Bureau to determine the nature of the reaction and to study some of the properties of its product. It is reported in the Journal of Research for March (RP980 by Milton Harris, Ralph Mease, and Henry Rutherford).

Data have been secured on the way in which wool is affected by treatment with solutions of sulfuric acid of different concentrations at 5, 25, and 50° C for 15 minutes, and with an 80-percent solution of sulfuric acid at 25° C for different lengths of time. The results suggest that strong sulfuric acid reacts with the basic groups in wool to form sulfamic acid derivatives. The acid-combining capacity decreases and the base-combining capacity increases in proportion to the number of sulfamic acid groups formed in the wool.

### DETERMINATION OF ALPHA, BETA, AND GAMMA CELLULOSE IN PULPS AND PAPERS

Herbert F. Launer, in the Bureau's Paper Section, has developed improved procedures for determining the amounts of alpha, beta, and gamma cellulose in pulps, rag stock, and papers, which should be of interest to paper chemists.

Alpha cellulose has been shown by investigators at the Bureau and elsewhere to be closely related to the stability of paper. Stable papers for record purposes are characterized by a high content of alpha cellulose, which is recognized as a criterion of stability. A correlation of the beta and gamma

cellulose values with the physical properties or stability of papers has not yet been effected, hence the interest in these quantities is as yet more in the scientific field than in the field of practical application.

The usual methods of determining the amounts of these cellulose components are essentially gravimetric. An improved method described in RP979 in the March Journal of Research, by which cellulose is determined oxidimetrically with dichromate, is completely volumetric, in that it involves no precision weighings whatever, as contrasted with the 28 weighings (for duplicate tests) necessary in a gravimetric method. It is as precise as the gravimetric methods, which are usually the standards of accuracy in chemistry, but has the advantage of being far simpler and shorter. Moisture and ash determinations, for example, are not necessary in this method, whereas they are indispensable in all others. The actual working time for four complete determinations is 1½ to 2½ hours, which is about ⅛ to ¼ of the time required by a gravimetric procedure. The gravimetric methods require samples weighing from 1 to 5 g, whereas this volumetric method employs a 0.3-g sample. Even a 0.03-g sample, corresponding to a piece of paper the size of an ordinary postage stamp, yields fair results. The advantages of a method capable of precision with such small samples are important, since often only small test specimens are available.

### PERMEABILITY OF PACKAGING MATERIALS TO WATER VAPOR

The following is an abstract of remarks by F. T. Carson of the Bureau's Paper Section at a symposium on testing the water permeability of paper, held as part of the annual meeting of the Technical Association of the Pulp and Paper Industry in New York City on February 24.

A review of methods and results reported in the literature affords perspective to the problem of formulating a standard method for measuring the water-vapor permeability of packaging materials. The information has been obtained from about 30 sources, and comparative data on about 20 types of material have been tabulated.

The methods that have been used are of four general types. (1) In the familiar cup or dish method the amount of moisture passing through the specimen sealed over the dish or cell is determined by the increase or decrease in the weight of the dish. (2) The specimen is a septum between two air streams of different humidity, and the transpired moisture is determined by the gain or loss in the weight of absorption bottles. (3) Saturated water vapor is admitted to a previously evacuated space in contact with one face of the specimen. The amount of moisture passing through is measured either by absorbing it in a desiccant suspended from a quartz fiber balance, or by means of the change in pressure on the low-pressure side. (4) Saturated water vapor is in contact with one face of the specimen, and the amount that passes through into an evacuated space is measured by means of a flow tube having ionization gages at each end.

Ten variables recognized by the various investigators are: Time, area, edge seal, thickness, vapor pressure difference, relative vapor pressure, total pressure, temperature, Von Schroeder effect, and intervening air spaces (or rate of diffusion through still air). Some of these variables can be taken care of in the unit chosen to express the results, whereas others must be specified in the testing apparatus, conditions, and procedure. The relation of vapor-pressure difference to the rate of transpiration of moisture is perhaps the most controversial of the relations of major importance. Although the evidence on this point seems at first hopelessly confusing, it can be classified in a fairly consistent pattern.

The comparative data tabulated for various materials indicate that the water vapor permeability of packaging materials ranges all the way from that of varnish films and rubber to that of leather and textile fabrics. In the effort to formulate a standard method for packaging materials it should be possible, therefore, to derive much stimulus and assistance from the results of many workers who have reported on various other materials.

### FIELD TESTS OF NONBITUMINOUS PIPE COATINGS FOR UNDERGROUND USE

The study of metallic pipe coatings was begun at the Bureau in 1922 and the study has been extended from time to time. The latest results of this study are given in a paper (RP982) by K. H. Logan and S. P. Ewing in the Journal of Research for March.

Two varieties of aluminum-coated pipe (calorized pipe) were exposed to three soils for 10 years. The coatings materially reduced the rates of corrosion in most of these soils, but com-

plete protection was secured in none of them.

Although lead is resistant to corrosion in most soils, especially those containing sulfates, many soils are sufficiently corrosive to penetrate a thin lead coating within a few years. When the iron or steel beneath the coating has been exposed, galvanic action between the two metals frequently accelerates the corrosion of the ferrous metal, and the lead-coated pipe may be punctured before an uncoated one of the same pipe-wall thickness. For these reasons lead coatings similar to those tested, of average thickness up to 1.5 mils, do not afford adequate protection against soil corrosion.

Hot-dipped zinc coatings (galvanized coatings) have been studied to discover their resistance to different types of soils and to determine the effects of the thickness of the coating and of the character of the base metal to which the coating is applied. In most soils serious pitting does not occur until nearly all the zinc has been removed from the specimen. The rate of loss of weight of galvanized steel is less than the rate of loss of either zinc or steel. The reason for this is probably the peculiar variation of potential of galvanized coatings as the metal is removed, which property tends to oppose any galvanic currents set up by soil corrosion. There was no noticeable difference in the rates of corrosion of galvanized coatings in different base metals. Thicker galvanized coatings are better than thin ones; the minimum thickness for adequate protection in most soils is approximately 2 oz./ft.$^2$ of surface.

The results of testing a group of nonmetallic, nonbituminous coatings are given. As in earlier experiments, thin coatings involving the use of a volatile solvent proved unsatisfactory. A vitreous enamel and two rather thick hard-rubber compounds withstood the action of corrosive soils very satisfactorily for 2 years. The test of these materials is being continued.

### HYDROCARBONS IN A MIDCONTINENT PETROLEUM

During the past 10 years the American Petroleum Institute has supported a research project at the Bureau, with the object of determining the fundamental properties of the hydrocarbons in a midcontinent petroleum. This work was originally in charge of Dr. E. W. Washburn. Since Doctor Washburn's death it has been carried on by Dr. Frederick D. Rossini, chief of the section on thermochemistry and constitution of petroleum. Recently, Doctor Rossini prepared a table summarizing the results of this research to date. This gives the formula, name and type of hydrocarbon, boiling point at 1 atmosphere, amount present in the crude, purity of best sample, and reference to the Research Paper in which the work on each particular hydrocarbon is reported in detail. In all, 44 hydrocarbons are listed.

While the supply lasts, copies of this table may be obtained by writing to Dr. F. D. Rossini, Chemistry Division, National Bureau of Standards, Washington, D. C.

### OPTICAL ROTATION AND ATOMIC DIMENSION FOR THE FOUR OPTICALLY ACTIVE 1-HALOGENO-2-METHYLBUTANES

The pure optically active 1-fluoro-, chloro-, bromo-, and iodo-derivatives of 2-methylbutane have been prepared. In the Journal of Research for March (RP978), a classification of their active forms is made and on this basis the numerical relation of the differences of molecular rotations of these compounds (Cl-F), (Br-Cl), and (I-Br) is 41 : 18.1 : 21.6, which agrees very well with the numerical relation for the differences of the respective atomic radii (41 : 16 : 21).

### PREPARATION OF THIN FILMS

T. P. Sager of the Bureau's Chemistry Division has developed a new process for preparing thin films. The film material, in the form of its solution in a volatile solvent, is applied to one surface of regenerated cellulose sheeting which has not been coated with a moisture-proofing composition. After evaporation of the solvent (and if necessary, curing of the deposited film), the uncoated surface of the regenerated cellulose is covered with water. Within a short time the film may be loosened and removed without stretching or other damage. Thin films of rubber, Thiokol, Neoprene, cellulose derivatives, and oleo-resinous varnishes have been prepared in this way.

### SURFACE TENSION OF MOLTEN ENAMELS

The surface tension of molten enamels, within the temperature range in which they are fired on metal shapes, has long been a matter of interest to the industry because certain troublesome surface characteristics, including those known as "orange peel" and "crawling", have been supposed to be caused wholly or partly by improper

surface tension. As a part of a long-range plan of study, the surface tensions of eight commercial type enamels, representative of as many classes, are being determined. The method being used is to weigh, by means of a torsion wire balance with optical lever, the amount of enamel which is supported through surface tension acting on a hollow platinum cylinder. This cylinder is suspended with its bottom edge at the normal surface level of the enamel.

Due to the high apparent viscosity of enamels in this range of temperature (approximately 500 to 25,000 poises) the time required to reach equilibrium would be many hours were the system not forced to a condition near equilibrium. When this precaution was taken, however, and equilibrium approached from both sides, it was possible in tests made so far to obtain satisfactory results. A "soft" ground coat and cover coat, and a "hard" ground coat, all gave results approximating 240 to 250 dynes per centimeter surface tension. Additional tests are in progress.

### RELATION BETWEEN WATER CONTENT AND FLOW PRESSURE OF A CLAY

In a previous investigation (Performance of a Hollow-Ware Extrusion Machine with Different Combinations of Augers, Spacers, and Dies, J. Research NBS 14, 711 (1935) RP798) in which a fine-grained plastic Maryland clay was used, over 300 determinations of water contents of the clay and the corresponding flow pressures were made. The data after serving their original purpose were later analyzed to determine the relation between percentage water content of the clay and the pressure necessary to produce flow.

The range of water content of the clay was narrow, inasmuch as it was varied from about 23.8 to 26.2 percent to maintain proper working conditions for stiff mud clay. In order to obtain a greater spread of data, additional flow pressure determinations were made between water contents from 17.18 to 34.07 percent, and the respective flow pressures ranged from 467.65 to 17.14 lb/in.$^2$

The curve obtained from the plotted data is hyperbolic in character of the form $(w-a)^m\ (p+b)=k$, in which

$w$=percentage water content of the clay
$p$=pressure in lb/in.$^2$ when flow ceases and $a$, $b$, $m$, and $k$ are constants.

The values of the constants satisfying the experimental conditions are

$a$=4.00
$b$=5.75
$m$=3.87
$k$=10,344,762

The value of the asymptote $a$ indicates that the clay (in solid form) requires theoretically 4 percent of water before it begins to lose the properties of a solid and becomes amenable to flow at infinite pressure. When the applied pressure $p$=0, the water content of the clay $w$=45.32 percent, the percentage at which the clay would theoretically be mobile under an increment of applied pressure.

Determination of the relation between water content and flow pressure has been completed on only the one clay. It is, however, a well known fact that different types of clay require different amounts of water to place them in the same mobile condition in which they can be formed into clay wares. It is, therefore, evident that the constants $a$, $b$, and $k$, while constant for a given clay under a given set of experimental conditions, will be different for different clays. These factors may therefore serve as a means of throwing more light on that elusive property "plasticity" and also serve as a means for classifying clays according to their "workabilities." Whether the exponent $m$ is constant or not for all clays under the same set of experimental conditions remains to be determined.

### RECENT PROGRESS IN ENGINEERING MATERIALS

A brief summary of recent progress in engineering materials, particularly during the year 1936, has been prepared by H. L. Whittemore for publication in Engineering News Record. In this summary attention is called to the fact that this country, having passed the "pioneer stage", must use less material and fabricate it more elaborately. The rapidly increasing use of plywood is a good illustration of this trend. However, the greatest obstacle to the efficient use of the many materials now available commercially is the lack of reliable data on their properties.

The article outlines the great increase in the use of Douglas fir plywood, laminated wood structural members, and metal timber connectors. Alloy structural steels are being used instead of carbon steels because of their

greater resistance to corrosion. Ferrous castings for automobile crank shafts and light alloys for truck and tank bodies are general. Sheet steel generally used for automobiles and furniture may come into use for houses.

Present knowledge of underground corrosion of metals is outlined as well as recent progress in masonry materials, cement, building units, etc.

Some of the more important problems connected with heat insulation and sound insulation are mentioned.

It appears probable that such materials as rubber and organic plastics would be more widely used if the engineering data required by the designing engineer were available.

### ANODIZING OF ALUMINUM ALLOYS IN CHROMIC ACID SOLUTIONS

Some of the strong aluminum alloys of the type known as duralumin are susceptible to corrosive attack in the saline atmospheres found near the seacoast. Protection against this attack can be obtained by using the alloy as the anode in an electrolytic bath consisting of a solution of chromic acid. By this reaction, an oxide coating is formed on the anode, in contrast to the metal deposit produced on the cathode in electroplating. R. W. Buzzard, in the Bureau's Metallurgical Division, found that a definite succession or cycle of voltages was required to produce the best coating in 3-percent chromic acid solutions. This cycle necessitated discontinuous operation of the bath. As explained in RP975 in the March number of the Journal of Research, a marked improvement was obtained by increasing the chromic acid content from 3 percent, the usual concentration, to 5 or 10 percent. The coatings produced were superior in their corrosion resistance and the conditions of operation were simplified so that continuous operation was possible.

### DETERMINATION OF OXYGEN IN STEEL

The accuracy and limits of usefulness of the various methods employed for the determination of oxides and oxygen in ferrous materials, have long been subjects of controversial discussion. In an attempt to clarify the situation a program of international cooperative analyses was arranged under the joint sponsorship of the Bureau and the Iron and Steel Division of the American Institute of Mining and Metallurgical Engineers.

As set forth in a paper by J. G. Thompson, H. C. Vacher, and H. A. Bright (RP976) in the Journal of Research for March, a critical review of the data from reports of 35 laboratories, comprising results of more than 2,000 analytical determinations, indicates that the vacuum-fusion method is accurate for simple carbon steels either of the rimming type or killed with silicon or aluminum; the aqueous-iodine method yields accurate results for some types of killed steels and low results for other steels; more data, and particularly more concordant data, are necessary to define the accuracy of the other methods employed in this cooperative analysis.

The vacuum-fusion procedures are reviewed and recommendations given for avoiding errors in this method.

### SUPERCONDUCTING TRANSITION OF TANTALUM AND OF TIN

When cooled to very low temperatures, certain materials show the astonishing property of completely losing their resistance to the flow of electric current. The phenomenon is called "superconduction", and a study of it is important because of the information such studies may give as to the nature of electrical conduction in general and the reasons why this most desirable phenomenon does not occur at ordinary temperatures.

Measurements of the electrical resistance of samples of material are usually made by the use of only small currents, and under this condition the transition from the superconducting to the normal (resisting) state takes place smoothly and continuously, although it may occupy only a very narrow range of temperature.

When the resistances of certain specimens were measured at the Bureau while a relatively large current was flowing in them, it was found that the transition was not continuous. As the temperature was raised slowly, the resistance of the specimen jumped rapidly to nearly its full value and then spontaneously decreased again nearly to zero. An appreciable further increase in temperature was then required to bring in the resistance permanently. Such an "overshoot" in resistance had not previously been reported. It has been found in two specimens of tantalum and one of tin. In RP977 by F. B. Silsbee, R. B. Scott, and F. G. Brickwedde (Journal of Research for March), the combinations of temperature, current in the specimen, and external magnetic field at which the overshoots appear have been mapped

out, and a tentative explanation of the effect is proposed.

### ANALYSIS AND SPECIFICATION OF COLOR

Methods of analyzing and specifying colors are discussed by Kasson S. Gibson in a paper which will be published in the Journal of the Society of Motion Picture Engineers.

Doctor Gibson points out that color is an important factor in nearly every article of commerce, affecting its sales value in one of the following three ways:

(1) The color may be the primary property because of which the article is desired. This is true of dyes, pigments, and paints.

(2) The color may be an indication of the quality or identity of an article, as in the case of vegetable and mineral oils, sugars and syrups, dairy products, flour, glass, paper, and raw materials, such as cotton, wool, and silk.

(3) The article may be artificially colored for the purpose of producing and increasing sales appeal. Such materials include textiles and wearing apparel of all kinds, automobile finishes, furniture, enamels and porcelains, and candy and other foodstuffs.

The annual trade value of these materials is in the billions of dollars. The analysis and control of colors is thus seen to be a matter of great importance in commerce and industry. When one realizes that there are millions of perceptibly differing colors, any of which it may be desired to analyze and specify, the necessity of colorimetric research and testing can readily be understood.

Various methods of describing colors and of measuring and specifying color stimuli are available, the character of the problem determining which of these is most suitable. The methods discussed include: (1) color names, (2) systems of material color standards, (3) colorimeters; and (4) colorimetric computations based on spectrophotometric data. The colorimetry of both illuminated objects and illuminants is considered, together with various methods of colorimetric specification.

### NEW CIRCULAR ON INKS

A new circular on inks (C413) was received from the printer last month. It is the fourth publication on this subject which the Bureau has issued, the last one being Circular C400, which was published in 1933.

The new circular, which supersedes all those previously issued on this subject, stresses more particularly methods for making ink, although testing procedures are included. As in the previous circular, the appendix contains a list of suitable dyes, and conversion factors which will be found useful when formulas are given in the metric units. A brief historical summary and descriptions of the various kinds of inks, grouped in two major classes, with sections on such subjects as aging of writing, restoration of faded writing, and ink eradicators, make the circular a reasonably complete and extremely interesting treatise on this popular subject.

Copies of C413 are obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 10 cents each.

### NEW AND REVISED PUBLICATIONS ISSUED DURING FEBRUARY 1937

#### Journal of Research[1]

Journal of Research of the National Bureau of Standards, volume 18, number 2, February 1937 (RP966 to RP974, inclusive). Price 25 cents. Obtainable by subscription.

#### Research Papers[1]

[Reprints from the November and December 1936 Journal of Research]

RP945. Soil-corrosion studies, 1934. Rates of loss of weight and penetration of nonferrous materials. Kirk H. Logan. Price 10 cents.

RP948. Electron concentration and spectral intensity distribution in a cesium discharge. Fred L. Mohler. Price 5 cents.

RP950. Stability of motion-picture films as determined by accelerated aging. John R. Hill and Charles G. Weber. Price 5 cents.

RP952. Differences in limes as reflected in certain properties of masonry mortars. Lansing S. Wells, Dana L. Bishop, and David Watstein. Price 5 cents.

RP955. Isolation of an isononane from petroleum—Its fractionation from naphthenes by distillation with acetic acid. Joseph D. White and Frank W. Rose, Jr. Price 5 cents.

---

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, and Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

### Circulars [1]

C413. Inks. C. E. Waters. (Supersedes C400.) Price 10 cents.

### Technical News Bulletin [1]

Technical News Bulletin no. 238, February 1937. Price, 5 cents. Obtainable by subscription.

## MIMEOGRAPHED MATERIAL

### Letter Circulars

Letter Circulars are prepared to answer specific inquiries addressed to the National Bureau of Standards and are sent only on request to persons having definite need for the information. The Bureau cannot undertake to supply lists or complete sets of Letter Circulars or to send copies automatically as issued.

LC488. Air-conditioning: Publications of interest. (List of selected publications.)

LC489. Inside wall paint for chemical laboratories (heat- and fume-resisting enamel paint).

### Technical Information on Building Materials

The supply of these notes, each of which consists of three or four pages giving the important facts on some one aspect of the properties or use of building materials, is necessarily limited. Their distribution will be confined to Government officials concerned with building projects, and to architects, engineers, and home builders. Requests should make clear the actual need for the information at the time of writing. Letters should be addressed to the Division of Codes and Specifications, National Bureau of Standards, Washington, D. C. The following note was issued since the list published in the February 1937 number of the Technical News Bulletin:

TIBM–44. Paint drying oil—linseed.

### Reports of National Hydraulic Laboratory

Copies are sent only in answer to specific requests addressed to the National Bureau of Standards.

Current hydraulic laboratory research in the United States, Bulletin (series A), V–1 (January 1, 1937).

Hydraulic laboratories in the United States. Addendum to first revision, series B (January 1937).

## RECENT BUREAU ARTICLES APPEARING IN OUTSIDE PUBLICATIONS [2]

Insolation, earth and sky brightness. R. P. Teele. Special Publication on Stratosphere Flight Contributed Technical Papers, Stratosphere Series No. 2, p. 133 (National Geographic Society, Washington, D. C.) (1936).

ASA committee keeps standard on dry cells up-to-date. G. W. Vinal. Ind. Standardization and Comm. Stds. Mo. (29 West Thirty-ninth Street, New York, N. Y.) **8**, 49 (February 1937).

A spectrographic study of Φ Persei. Herbert F. Schiefer. Astrophys. J. (c/o Dr. Otto Struve, Yerkes Observatory, Curtis Bay, Wis.) **84**, 568 (December 1936).

Observing an eclipse in Asiatic Russia. Irvine C. Gardner. Nat. Geographic Mag. (Sixteenth and M Streets NW., Washington, D. C.) **71**, 179 (February 1937).

Methoden zur messung der ultravioletten sonnenstrahlung in absoluten einheiten. W. W. Coblentz. Sonderdruck aus der Meteorologischen Zeitschrift (Friedr. Vieweg & Sohn, Braunschweig, Germany) **12**, 1 (1936).

Methods of evaluating ultraviolet radiation in absolute units. W. W. Coblentz. Mo. Weather Rev. (U. S. Weather Bureau, Washington, D. C.) **64**, 319 (October 1936).

Standard methods for the sampling and analysis of commercial soaps and soap products, revised. F. W. Smither, R. E. Divine, C. P. Long, M. L. Sheeley, H. P. Trevithick, and P. H. Walker. Anal. Ed., Ind. and Eng. Chem. (Mills Building, Washington, D. C.) **9**, 2 (January 15, 1937).

A simplified procedure for determining normal boiling points by the comparative method. Mieczysław Wojciechowsky. Nature (London, England) **138**, 1096 (December 26, 1936).

Standard tests for comparing quality of dress fabrics. H. A. Ehrman. Ind. Standardization and Comm. Stds. Mo. (29 West Thirty-ninth Street, New York, N. Y.) **8**, 28 (January 1937).

[1] Send orders for publications under this heading only to the Superintendent of Documents, Government Printing Office, Washington, D. C. Subscription to Technical News Bulletin, 50 cents per year; Journal of Research, $2.50 per year (United States and its possessions, and Canada, Cuba, Mexico, Newfoundland, and the Republic of Panama); other countries, 70 cents and $3.25, respectively.

[2] These publications are not obtainable from the Government, unless otherwise stated. Requests should be sent direct to the publishers.

Machine for testing fabrics. Wm. D. Appel and H. F. Schiefer. Patent 2,066,311 (U. S. Patent Office, Washington, D. C.) (January 5, 1937).

Apparatus for testing coated fabrics. Roy C. Bowker. Rayon Textile Mo. (303 Fifth Avenue, New York, N. Y.) 28, 57 (January 1937).

The probable error in the measurement of the tensile strength of heavy leather. John Beek, Jr., J. Am. Leather Chem. Assn. (Ridgway, Pa.) 32, 4 (1937).

The soluble decomposition products in aged vegetable tanned leather. Joseph R. Kanagy. J. Am. Leather Chem. Assn., 32, 12 $1937).

Baths for anodic treatment of aluminum. R. W. Buzzard. Patent 2,066,827 (U. S. Patent Office, Washington, D. C.) (Issued January 8, 1937.)

Who will accept responsibility for quality in the future? I. J. Fairchild. Bul. Nat. Retail Dry Goods Association (101 West Thirty-first Street, New York, N. Y.) 19, 9 (January 1937).

Eye injuries from intense radiation. Morton G. Loyd. Safety Engineering (75 Fulton Street, New York, N. Y.) 73, 35 (January 1937).

Model subdivision regulations. A guide for local planning commissions in the preparation of local regulations governing the subdivision of land. Prepared by the Advisory Committee on City Planning and Zoning, National Bureau of Standards. (December 1936) Distributed by the National Resources Committee, Washington, D. C.

U. S. GOVERNMENT PRINTING OFFICE: 1937